

Claims

1. A lens array structure comprising a first birefringent lens array and a second birefringent lens array arranged in series, wherein
  - 5 both the first birefringent lens array and the second birefringent lens array are capable of operating to direct incident light of one polarisation into a respective directional distribution and to have substantially no effect on incident light of a polarisation perpendicular to said one polarisation, and
    - the first birefringent lens array and the second birefringent lens array are
    - 10 relatively oriented such that incident light of a first polarisation component is directed into a directional distribution by the first birefringent lens array and not affected by the second birefringent lens array whereas incident light of a second polarisation component polarised in a direction perpendicular to said first polarisation component is not affected by the first birefringent lens array and directed
    - 15 into a predetermined directional distribution by the second birefringent lens array.
2. A lens array structure according to claim 1, wherein the first birefringent lens array and the second birefringent lens array are cylindrical lens arrays.
- 20 3. A lens array structure according to claim 1 or 2, wherein the first birefringent lens array and the second birefringent lens array each comprise a birefringent material and an isotropic material having a curved surface therebetween.
4. A lens array structure according to claim 3, wherein the birefringent materials  
25 of the first and second birefringent lens arrays have the same ordinary and extraordinary refractive indices, the ordinary axes of the birefringent materials of the first and second birefringent lens arrays are oriented in directions corresponding to said first polarisation component and said second polarisation component, respectively, and the isotropic material of both the first and second birefringent lens arrays have the same refractive index equal to one of the ordinary and extraordinary

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refractive indices of the birefringent material of the first and second birefringent lens arrays.

5. A lens array structure according to claim 3, wherein the birefringent materials  
of the first and second birefringent lens arrays have the same ordinary and  
extraordinary refractive indices, and the isotropic material of one of the first and  
second birefringent lens arrays has a refractive index equal to the ordinary refractive  
index of the birefringent material and the other of first and second birefringent lens  
arrays has a refractive index equal to the extraordinary refractive index of the  
10 birefringent material.

6. A lens array structure according to claim 5, wherein the first birefringent lens array  
and the second birefringent lens array comprise common birefringent material.

15 7. A lens array structure according to claim 3, wherein  
the ordinary axes of the birefringent materials of the first and second  
birefringent lens arrays are oriented in directions corresponding to said first  
polarisation component and said second polarisation component, respectively,  
the first isotropic material has a refractive index equal to one of the ordinary  
20 and extraordinary refractive indices of the first birefringent material; and  
the second isotropic material a same refractive index equal to one of the  
ordinary and extraordinary refractive indices of the second birefringent material.

8. A lens array structure according to any one of the preceding claims, wherein  
25 both the first birefringent lens array and the second birefringent lens array are passive  
lens arrays.

9. A lens array structure according to any one of claims 1 to 7, wherein at least  
one of the first birefringent lens array and the second birefringent lens array is an  
30 active lens array switchable between a first mode in which it directs incident light of

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one polarisation into a respective directional distribution and has substantially no effect on incident light of a polarisation perpendicular to said one polarisation and a second mode in which it has substantially no optical effect.

- 5    10.    A display apparatus comprising:
  - a spatial light modulator;
  - a lens array structure according to any one of claims 1 to 8; and
  - a switchable polarisation control device arranged to control the polarisation of light passing through the display to output from the display device light of a
- 10    polarisation component selectively corresponding to either said first polarisation component or said second polarisation component.
  
11.    A display apparatus comprising:
  - a spatial light modulator;
  - 15    a lens array structure according to claim 9;
  - a switchable polarisation control device arranged to control the polarisation of light passing through the display to output from the display device light of a polarisation component selectively corresponding to either said first polarisation component or said second polarisation component; and
- 20    a control circuit arranged to control switching of the at least one active lens array.
  
12.    A display apparatus according to claim 11, wherein the switchable polarisation control device comprises a switchable polariser arranged pass light
- 25    having a polarisation component selectively corresponding to either said first polarisation component or said second polarisation component.
  
13.    A display apparatus according to claim 11, wherein the switchable polarisation control device comprises a switchable polarisation rotator.

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14. A display apparatus according to claim 13, wherein the spatial light modulator is arranged to output substantially polarised light and the switchable polarisation rotator is arranged between the spatial light modulator and the lens array structure.

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15. A display apparatus according to claim 13, wherein the spatial light modulator is arranged to output substantially polarised light and the display apparatus further comprises a linear polariser arranged on the output side of the switchable polarisation rotator.